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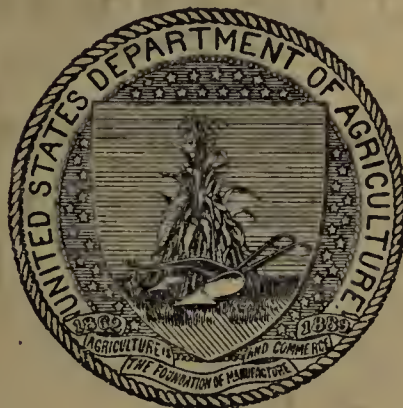
A. C. TRUE, Director.

DRAINAGE OF THE WET LANDS OF
EFFINGHAM COUNTY, GA.

BY

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PREPARED UNDER THE DIRECTION OF

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., May 15, 1911.

SIR: I have the honor to transmit herewith a manuscript by F. G. Eason, drainage engineer, prepared under the direction of C. G. Elliott, chief of drainage investigations, on Drainage of the Wet Lands of Effingham County, Ga. This report deals with the general drainage conditions of the county and the various elements which enter into the solution of the problem. A drainage map has been prepared showing the natural watersheds into which the territory is divided, suggestive of the boundaries of the drainage districts which should be formed.

A plan for the improvement of Mill Creek has been worked out as illustrative of the methods of reclaiming overflow bottom lands. An appendix gives a list of bench marks which will be useful in carrying out any drainage surveys in the future.

In order that an interest in drainage matters may be aroused and the drainage of lands promoted not only in Effingham County but also in the many other districts of Georgia needing reclamation, it is recommended that this report be published as a circular of this office.

Respectfully,

A. C. TRUE,
Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

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DRAINAGE OF THE WET LANDS OF EFFINGHAM COUNTY, GA.

INTRODUCTION.

The investigation of the drainage conditions in Effingham County, Ga., was made at the solicitation of Hon. C. G. Edwards, who, late in 1910, requested that drainage investigations, Office of Experiment Stations, United States Department of Agriculture, make an examination to determine the possibility of reclaiming the wet lands of the county. In replying to this request, C. G. Elliott, chief of drainage investigations, expressed his intention of causing an investigation to be made with a view to reporting in full on the possibilities of drainage betterment in the county, but stated further that the examination was to be of a preliminary nature, the question of a more detailed examination and survey to be held in abeyance. Accordingly, Mr. Elliott directed Mr. F. G. Eason, assistant drainage engineer, to proceed with the examination along these lines.

Mr. Eason took up the investigation on February 6, 1911, completing the same on March 3. Subsequently he spent another week in the field for the purpose of obtaining some detailed information with regard to Mill Creek. The examination was conducted with Savannah, Ga., as a base. All of the railroads were gone over, and several hundred miles of roads were traversed. Every section of the country was visited, and many persons were questioned for information, which was later verified. Those interested in the movement in the various towns very kindly gave what assistance they could.

In this report is set forth the present drainage status in Effingham County as observed, also the possibility of improving conditions is discussed, and methods of accomplishing the work are suggested. The report also contains the results of a more detailed examination of Mill Creek, including recommendations for draining the 12,200 acres of its watershed and giving an estimate of the probable cost of the work.

The general map of Effingham County (fig. 1) that accompanies this report was made from an existing county map, supplemented by data obtained in traveling over the county. It is only approximately correct but serves the purpose for which it is here presented.

GENERAL DESCRIPTION OF EFFINGHAM COUNTY.

Effingham County lies in the extreme eastern part of Georgia, between the Savannah River on the east and the Ogeechee River on the west. Roughly a parallelogram in shape, it has an area of about 375 square miles. It is one of the oldest counties in the State and contains one of the first settlements made in this part of the country—that at Ebenezer Church, on the Savannah River, made about the year 1765. The present population of the county numbers about 10,000, a considerable portion of whom are descendants of the early settlers. They are a conservative, industrious class, mostly of German descent.

Springfield, the county seat, and Guyton are the two largest towns in the county; other towns are Clyo, Egypt, Rincon, and Meldrim.

TOPOGRAPHY.

There is but one county (Chatham) lying between Effingham County and the seacoast, and this nearness to the ocean accounts in a measure for the general flatness of the lands. The southern portion of the county is extremely flat and contains several large bays or swamps, which have very poor drainage outlets through the branches and creeks. These latter are for the most part small, sluggish streams meandering their way through fairly wide swamps and are usually choked up by logs, trees, and bushes. The condition is typical of all the streams in the county except some few in the central and northern portions, which do not have such wide swamps and which have much greater fall. The topography of the central portion of the county, particularly the section around Springfield, is entirely different in character from that of the southern part and consists of rolling land sloping gradually to the branches, where it drops off suddenly, sometimes as much as 25 or 30 feet. The branches in this section are quite numerous. (See fig. 1.) The need of drainage is not so apparent in the central portion as elsewhere, nor is it so difficult to obtain it. The northern portion of the county is, in topography, a mean between the southern and central portions; while it contains large areas of flat lands, these are not so flat as those in the south, nor are they as undulating as are the lands in the central portion. The northern section does not contain as much swamp area as is found in the central and southern portions, but contains large areas of flat lands which by means of a little drainage could be made very productive.

The greater portion of the lands of the county would be classed as "flat piney woods," but there are several sections where this would not apply, notably along the Louisville Road and near the Ogeechee River, where many sand beds are encountered underlain with clay





at some depth and supporting a sparse growth of forked leaf black-jack oaks. In places, however, sandy loam, underlain with clay at 12 to 18 inches, is found, and good crops are here produced. The greater part of the area of the county will make good farming land as evidenced by the crops raised at the present time on the lands under cultivation.

One peculiar feature of the topography of the county to which it is desired to call attention is the existence of ridges which parallel both rivers bordering the county. These ridges are quite high in some places and cut off the drainage to the rivers, except through the creeks which empty into them. They are usually situated along or very close to the edge of the river swamp.

The main divide or watershed boundary of the county runs through its entire length in a southeasterly direction, paralleling the Ogeechee River, and lying about 6 miles distant from it. About two-thirds of the area of the county lies to the east of this divide and drains into the Savannah River, while the remaining third drains westerly into the Ogeechee River and Ogeechee Creek, the latter having, as a matter of fact, a watershed independent of the two main ones above described and flowing directly to the ocean. The numerous smaller creeks and branches each have their individual watersheds, but these are all subsidiary, as they empty into one or the other of the before-mentioned streams. It will therefore be seen that there are but three independent watershed districts in the entire country; all of these, however, can be subdivided into numerous minor ones, as may be seen by referring to the accompanying map. (Fig. 1).

SOIL.

The soil of the county, as a whole, appears to be of good quality. The predominating type is a light sandy loam, underlain by a sub-soil of stiff yellow or reddish clay, varying in depth from 2 to 24 inches. This is the soil most generally cultivated, and very good results are obtained from it with the addition of a little commercial fertilizer. Another class of soil is sandy and, so far as could be determined, appeared to contain little but sand. In some cases this is underlain by a sandy hardpan. This soil occurs mostly on the ridges bordering the rivers. The soil in the swamps and bays consists of a black muck in most cases and, judging from the present growths, will make excellent farm lands when drained. There is still another class of soil in the river swamps along the Savannah and Ogeechee Rivers. This is an alluvial soil deposited by the rivers during time of overflow and is of excellent quality. The soil of the Savannah River bottoms is of a dark-yellow color, owing to the fact that it is brought down from the red clay hills. That of the Ogeechee River bottoms is mostly of a dark-brown color or black.

INDUSTRIES AND TRANSPORTATION.

Effingham County is an instance of a section where very little farming is done, whereas it should be a thriving agricultural community. It is estimated that of the total lands of the county only from 5 to 8 per cent are under cultivation. This is due chiefly to the lack of drainage and scarcity of population, there being only about 25 people to the square mile. The vocation of the majority of the people is farming, the remainder being devoted mostly to the lumber and turpentine business, which still plays an important part in the affairs of the county. The class of farming here is as good as the average of the South, but there is room for the improvement that can be brought about by the practice of scientific methods and the use of more modern machinery. Very good crops are made, the chief ones being cotton and corn, although some oats, sugar cane, melons, and truck are planted. Crops of 1 bale of cotton to the acre and 50 to 60 bushels of corn are not uncommon in Effingham County.

There are five railroads in the county, three of which traverse it in a north-and-south direction. The Central of Georgia Railroad runs along the western portion of the county for its entire length, paralleling the Ogeechee River. The Brinson Railway is a new road, which has been in operation for only a few years and runs through the central portion of the county for its entire length. The Seaboard Air Line traverses the eastern part of the county to a point 3 miles above Clyo, where it crosses the Savannah River. Another branch of the Seaboard Air Line crosses the southwest corner of the county, while the Atlantic Coast Line touches the extreme southeast corner. It will thus be seen that the county is fairly well supplied with railroads.

The public roads are not up to the standard of those in the neighboring counties, but of late convict labor has been applied to them, with good results. The roads are, for the most part, very sandy.

DRAINAGE CONDITIONS.

The main drainage outlet for the county is the Savannah River, as it drains about two-thirds of the entire area. However, very few of the streams, except in the southern portion, flow directly into this river, the principal ones being Ebenezer Creek, Lechner Creek, and Abercorn Creek. In the central-eastern part are a few small branches which flow directly into the river. The largest tributary of the Savannah River, and by far the most important interior drainage channel of the county, is Ebenezer Creek. This creek rises in Screven County and flows south through Effingham County until opposite Springfield, where it turns and flows easterly into the Savannah

River. Above Springfield this creek is called "The Run" and has several large tributaries, the most important of which are Turkey Branch, Jacks Branch, Cowpen Branch, Devils Branch, State Bay, and Little Ebenezer Branch. This one creek, with its tributaries, drains about one-half the entire county and in some places in the northern part drains from within a few hundred yards of the Savannah River, the drainage being cut off from the river by the high ridges. A very large volume of water comes down this creek during heavy rains and it is a very difficult matter to maintain bridges over it. The creek has a well-defined channel at the lower end, but in the upper part it is similar to the other branches—crooked and choked up.

The Savannah River is a navigable stream up to the fall line, at Augusta, Ga. This river was surveyed by the United States Engineer's office at Savannah in 1889. - Very little information could be obtained regarding high-water marks, but the few following facts will be of interest. The fall from Augusta, Ga., to the sea is very nearly uniform and amounts to about 0.5 feet per mile. At Purysburg, S. C., 40 miles from its mouth, the extreme high-water level of the river, due to floods, is 20 feet, low water at this point being 6.6 feet, thus giving a range of 13.4 feet. The average width of the river along this county is about 500 feet. A gauge is maintained at Augusta, Ga., and from gauge readings and rating curves it has been determined that a height of 35 feet at this point will give a corresponding discharge of 155,000 cubic feet per second. For a 40-foot stage the discharge would be 370,000 second-feet, although a stage of 40 feet at Augusta has never been quite reached. Augusta is about 100 miles from Effingham County and, while no very large tributaries enter the river between these points, there are a number of smaller ones, so that along this county it is estimated that the discharge during extreme high water is 400,000 to 450,000 second-feet.

The next main drainage channel in importance is the Ogeechee River, which drains a scope of country about 6 miles wide in Effingham County, down as far as Marlow, where the watershed narrows down to hardly more than a mile in width. The main tributaries of the Ogeechee River are Lopers Creek, Mill Creek, Deep Branch, and Walden Branch. The Ogeechee River is not now classed by the War Department as a navigable stream along Effingham County, but there is a probability of its being so classed in the near future. There are several bridges across it which have no draws. No information as to high-water marks of this river could be obtained. The Geological Survey maintained for a few months a gauging station at Millen, Ga., which is situated on the Ogeechee River about 30 miles

above Effingham County. The measurements taken indicated that at a stage of 7 feet at Milan, the discharge would be 3,590 cubic feet per second, but it is not known how this stage compares with the maximum flood stage of the river, and as there are a number of tributaries entering the river between Effingham County and Millen the actual flood flow along Effingham County can not be estimated with the information at hand.

Ogeechee Creek heads east of Marlow and flows in a southerly direction, finally emptying into the Atlantic Ocean. This creek drains a district of from $2\frac{1}{2}$ to 6 miles wide. Monteith Creek and Black Creek originate in the southern portion of this county and flow through Chatham County to the Savannah River.

Each of the streams mentioned above is fed by many smaller tributaries, which divide the entire county into a network of small branches. All of these have some little flow during wet times and the greater portion of the year have water in them. They are the natural drainage outlets for the county and a glance at the map (fig. 1) can not but impress one with the facility with which a general drainage system could be laid out for the county, or, on the other hand, with the number of small drainage districts which could be formed owing to the great number of small branches. Each of these little branches drains its own scope of territory and has its function in the general system.

The areas drained by the three principal outlets are as follows: Savannah River, 255 square miles; Ogeechee River, 85 square miles; Ogeechee Creek 35 square miles; total, 375 square miles.

The present condition of the injured lands of this county is not due to a lack of adequate drainage outlets, but to the absence of proper connection with these outlets or to the fact that the drainage channels are badly obstructed by logs, trees, and bushes. This condition of affairs naturally causes the water to remain on the lands a large part of the time and also keeps the water table of the soil so close to the surface most of the year as to render the land unfit for cultivation. This is particularly true of the southern portion and applies also to portions of the northern part where there is so little difference between the elevation of the swamps and that of the adjacent lands.

RAINFALL AND RUN-OFF.

The United States Weather Bureau maintains no stations in Effingham County, but such stations are located at Savannah, Statesboro, and Brag. The records of these points may be taken to indicate very closely the precipitation in Effingham County. The record of rainfall at Savannah covers a period of more than 60 years; those of Statesboro and Brag are more or less incomplete and cover a much

smaller period. These records show that the annual rainfall for this district is close to 50 inches. The section is, however, subject to very heavy rainstorms lasting from but a few hours to several days. It is these comparatively short periods of heavy rainfall rather than annual or monthly precipitation that must govern the nature and scope of drainage improvements.

As an indication of the rainfall which an efficient drainage system in Effingham County must be designed to provide for, the following table of heavy storms is given:

Record of greatest storms at Savannah, Ga., in 15 years, 1896 to 1910, inclusive

[From the records of U. S. Weather Bureau.]

Years.	Date.	Rainfall.	Years.	Date.	Rainfall.	Years.	Date.	Rainfall.
		<i>Inches.</i>			<i>Inches.</i>			<i>Inches.</i>
1896.....	Jan. 16	2.53	1899.....	Aug. 27	1.52	1903.....	July 7	0.04
	May 3	1.26		Aug. 28	1.85		July 8	.81
	May 4	.38		Aug. 29	2.39		July 9	4.08
	May 5	1.19		Aug. 30	.17		Aug. 15	2.08
	May 6	.13		Sept. 16	.24		Sept. 13	.54
	Aug. 26	2.52		Sept. 17	2.32		Sept. 14	.91
	Nov. 30	.52		Sept. 18	1.60		Sept. 15	2.25
	Dec. 1	2.41		Nov. 25	2.01		Sept. 16	1.45
	Dec. 2	2.63		Jan. 18	2.16		Sept. 17	.36
	Feb. 25	2.62		Jan. 19	.28		Oct. 17	2.04
1897.....	July 22	2.00	1900.....	Jan. 20	.05	1904.....	Jan. 22	1.08
	Sept. 21	.67		Oct. 3	3.80		Jan. 23	1.07
	Sept. 22	2.30		Oct. 4	.75		July 21	.15
	Oct. 17	.75		Nov. 3	3.06		July 22	.92
	Oct. 18	3.42		June 12	.88		July 23	.41
	Oct. 19	2.51		June 13	2.49		July 24	2.52
	Oct. 20	.03		June 14	.16		July 28	4.80
	June 17	1.06		June 15	.29		July 29	1.63
	June 18	.27		June 16	.05		July 30	.33
	June 19	1.64	1901.....	June 17	1.59	1905.....	May 7	2.10
1898.....	July 10	1.16		Mar. 14	.30		June 15	2.74
	July 11	.16		Mar. 15	2.22	1906.....	June 26	.15
	July 12	2.39		Mar. 16	.38		June 27	.77
	July 13	1.75		July 11	.60		June 28	.51
	Aug. 16	1.47		July 12	2.72		June 29	5.07
	Aug. 17	4.16		July 12	1.92		June 30	.34
	Aug. 18	.04	1902.....	Oct. 25	.22		July 2	.30
	Aug. 26	.12		Oct. 26	2.58	1907.....	July 3	.89
	Aug. 27	3.44		Oct. 27	.47		July 4	2.09
	Aug. 28	1.13		Nov. 30	2.88		Sept. 12	1.03
	Aug. 29	.31		Dec. 1	.01		Sept. 13	.40
	Aug. 30	1.16		Dec. 2	.16		Sept. 14	1.07
	Aug. 31	7.31		Dec. 3	.58		Sept. 15	1.04
	Sept. 1	.87		Dec. 4	2.34		Sept. 16	.07
	Oct. 2	2.78		Mar. 29	3.27	1909.....	Aug. 23	2.71
	Nov. 16	.15	1903.....	May 7	.63		Aug. 27	.72
1899.....	Nov. 17	.31		May 8	2.44	1910.....	Aug. 29	8.38
	Nov. 18	4.13		May 9	.42		Aug. 30	.41
	Feb. 16	2.05		May 10	1.19			
	Aug. 26	.33		July 6	.34			

The storms tabulated above are divided among the months as follows:

January.....	3	May.....	3	September.....	4
February.....	2	June.....	4	October.....	5
March.....	2	July.....	6	November.....	3
April.....	0	August.....	7	December.....	2

It is readily seen from the above that heavy storms may be expected most frequently in the months from June to October, inclusive.

This fact is further shown in the following record of normal monthly precipitation at Savannah for a period of 60 years:

	Inches.		Inches.		Inches.
January.....	3. 12	May.....	3. 71	September.....	5. 45
February.....	3. 01	June.....	5. 41	October.....	3. 04
March.....	3. 67	July.....	6. 92	November.....	2. 16
April.....	2. 73	August.....	7. 74	December.....	3. 10

The greatest monthly precipitation in this section, as recorded by the Weather Bureau, occurred in August, 1898, when 33.02 inches fell at Brag. On three different occasions within the past 40 years more than 8 inches of rain have fallen at Savannah within 24 hours, and rainfalls of more than 2 inches in 24 hours are of comparatively frequent occurrence.

The water which is removed from a watershed through surface channels is known as run-off. The rate of run-off is the quantity of water removed in a unit of time. It is usually referred to in drainage work as a depth of water uniformly distributed over the watershed which is removed in 24 hours, but for purposes of calculation the rate of run-off may be expressed in cubic feet per second. The study of run-off, or more properly the rate of run-off, is essential in the design of efficient and economical drainage works.

The most important conditions affecting the rate of run-off are (1) the frequency and intensity of precipitation, (2) the area, shape, and topography of the watershed. The rate of run-off is further affected to a considerable degree by the nature of the soil and to a lesser extent by the state of cultivation of the watershed and the character and extent of vegetation. There are no two watersheds alike and the factors influencing the rate of run-off from any watershed are so interrelated that the question of run-off is not one for mathematical solution, but rather of judgment and experience.

The heavy rains which occur in Effingham County would point to the necessity of assuming a high rate of run-off for the section. Also the rolling character of the central portion of the county would tend to cause rapid accumulation of the water in the drainage channels, and thus necessitate outlets of large capacity. On the other hand, the soil is of such character as to take up large quantities of water and the heaviest rains occur in the season when growing vegetation requires and absorbs a large amount of water and when the rate of evaporation is high. In the northern and southern portions of the county the land lies much flatter than in the central part, and the removal of the water that falls upon these sections is therefore retarded and is extended over a greater interval of time, justifying the assumption of a smaller rate of run-off.

A rate of run-off of three-fourths inch in depth over watersheds in the central portion of the county, and of one-half inch for the flatter

northern and southern portions will, it is believed, afford a basis for such improvements as will give good drainage under normal conditions. It is not expected that the rates assumed would cover such rainfalls as occurred on August 29 of last year when more than 8 inches fell, or similar storms which have occurred at intervals of several years in the past. It is believed, however, that drainage systems based upon these figures will give good service under normal conditions, and can be constructed at a cost that will insure large returns on the investment.

According to the classification given above the principal streams in the three-fourths-inch district would be: The Runs, Ebenezer Creek, Turkey Branch, and Jacks Branch; and in the one-half-inch district: Mill Creek, Ogeechee Creek, Sweigoffer Creek, Montieth Creek, and Deep Branch.

HOW DRAINAGE CAN BE SECURED.

There are no serious engineering problems to be solved in devising a system of drainage for this county. The best plan to be followed is to complete what nature has indicated. A good natural system already exists and if followed up and completed will give all the relief desired. A system of canals should be dug in all the main branches and creeks of the county, and from these laterals could be run as often as necessary to accomplish the drainage of the interior portions. Even if canals can not be constructed a great deal of good could be accomplished by simply clearing the streams of trees and brush, thus giving the water a free flow. Each individual landowner could do this clearing and if done systematically it would result in much good.

There are no serious overflow conditions to contend with in the county except in the river bottoms, although upon one occasion water was known to flow from the Ogeechee River to the Savannah River near Eden. The river swamp along the Ogeechee River will average about three-fourths of a mile in width in Effingham County, and all of this land could be reclaimed by building a low dike along the river as the latter does not overflow the swamp to a depth exceeding 3 feet during the time of freshet. The Savannah River swamp is several miles wide, but most of it lies on the South Carolina side. It would hardly be a paying proposition to reclaim the overflowed land on the Effingham County side of the river, owing to the narrowness of the bottom and the height to which the levees would have to be built. There is, however, one portion where levees could be used to advantage; this is the section in the southeastern part of the county lying between Mill Creek and the river, as here the swamp is 2 to 3 miles wide. The Savannah River rises much higher than the Ogeechee during a freshet, overflowing the bottoms to a depth of 8 to 10 feet,

and hence it will take a much higher and more expensive levee to reclaim the lands along it, and protect them from overflow.

No organized effort has been made up to this time toward the draining of the swamp lands of Effingham County, and as a result no drainage has ever been attempted outside of one or two ditches in branches and the usual field ditches. Under the proposed drainage law of Georgia, however, the landowners adjoining one or more of these creeks or branches will be able to form a drainage district and drain their lands to the best advantage. The cost of draining these lands will not be unduly high if the work is done in a proper manner by cooperation and with concert of action, as no obstacles of import will be met with. For the purpose of determining what the approximate cost of drainage work would be in this county a more detailed examination was made of Mill Creek and improvements were planned and their probable cost estimated. The results of this examination are given in this report.

CONCLUSION.

In considering the attitude of the landowners of Effingham County on the question of drainage, the fact that they have had no experience in or observation of drainage works must be taken into consideration. While there are several landowners who are deeply interested in the question of drainage, and who are willing to devote time and money to it, it is not believed that the people as a whole would be willing to expend any considerable amount of money in this direction until they have been taught more about it, or have had some concrete example of drainage set before them. All of them concede drainage to be a good thing in the abstract, but most of them are content to let it rest at that. There are no proposed drainage districts in view at present, but it is believed that before long some will be established.

The present value of most of the land of the county with the timber cut off is from \$3 to \$10 an acre, and of land under cultivation from \$25 to \$60 an acre. If the people could be led to see that by the expenditure of a few dollars an acre for drainage purposes, they could increase the value and productivity of their lands several hundred per cent, they would probably look more deeply into the subject. It should be borne in mind that increased productiveness of the land would not be the only benefit derived from drainage where conditions are such as now exist in Effingham County. The abatement of mosquitoes and improvement in the health conditions of the county which could be expected to result from improved drainage are benefits that should by no means be overlooked.

The results of this investigation may be summed up in the following words:

(1) A large part of Effingham County, particularly the northern and southern portions, can not at present be cultivated, owing to the high level of the ground water and the prevalence of swamps and low flat areas which do not drain. These conditions are not caused by lack of natural drainage outlets, but by the shallowness and choked condition of these streams and by the lack of efficient connection between the low flat lands and the outlets. The bottoms along the Savannah and Ogeechee Rivers are subject to damage by overflow of these rivers.

(2) The best method of draining these lands consists in the construction of canals of proper dimensions in the main creeks and branches of the county, these canals to be fed by laterals constructed in the smaller branches and extending into the interior bays and swamps. This will afford a drainage system with which individual farm drains may be connected, and the drainage may, therefore, be as complete as desired by the landowner. The main canals should be of sufficient depth to form good outlets for the lateral system, the latter being made deep enough to keep down the ground-water level and form good outlets for the farm drains. This will require a depth of about 6 or 7 feet for the main canals and 5 feet for the laterals. The cost of providing these outlets for farm drains should be in the neighborhood of \$2.50 or \$3 per acre of benefited land. The bottom along the Ogeechee River may be protected from overflow by a levee not exceeding 6 feet in height, while the wide bottom land along the Savannah River adjoining Mill Creek, in the southeastern part of the county, would require a levee probably not less than 12 feet in height.

(3) While a number of landowners in the county are much interested in drainage and are no doubt ready to assume their share of the labor and expense necessary for its accomplishment, it does not appear that there is at present a general sentiment in the county in favor of undertaking the work.

The following list contains the names and addresses of some of those residents of Effingham County who appear to be most interested in the question of drainage, and from whom information of value was obtained:

George M. Brinson, Springfield, Ga.
Y. E. Barger, Springfield, Ga.
J. M. Guann, Springfield, Ga.
J. M. Hodge, Springfield, Ga.
H. J. Biddenback, Springfield, Ga.
W. A. Jandon, Springfield, Ga.

C. F. Berry, Springfield, Ga.
J. T. Wells, Guyton, Ga.
A. N. Grovenstine, Guyton, Ga.
G. M. Shearouse, Guyton, Ga.
R. W. Sheppard, Guyton, Ga.
C. T. Guyton, Guyton, Ga.

B. P. Powers, Guyton, Ga.	J. N. Zettler, Coldbrook, Ga. (Rincon P. O.).
W. T. Green, Clyo, Ga.	W. M. Exley, Exley, Ga.
R. P. Mallory, Clyo, Ga.	Wylly Jarrell, Exley, Ga.
Dr. W. W. Smith, Clyo, Ga.	J. B. Simmons, Rincon, Ga.
O. E. Metzger, Clyo, Ga.	E. E. Hinely, Rincon, Ga.
W. H. J. Foy, Egypt, Ga.	L. B. Ackerman, Rincon, Ga.
T. A. Dutton, Egypt, Ga.	W. H. Poythoes, Rincon, Ga.
A. B. Kieffer, Egypt, Ga.	L. F. Grovenstine, Ebenezer, Ga. (Rincon P. O.).
C. C. Wolfe, Egypt, Ga.	L. E. Seckinger, Ebenezer, Ga. (Rincon P. O.).
H. H. Scott, Eden, Ga.	A. L. Nease, Blandford, Ga.
J. H. Smith, Eden, Ga.	L. E. Dugger, Blandford, Ga.
J. L. Mattox, Meldrim, Ga.	J. A. Graham, Shawnee, Ga.
C. F. Cox, Meldrim, Ga.	W. W. Griffin, Shawnee, Ga.
W. L. Gignilliat, Pineara, Ga.	J. S. Guann, Bethel, Ga. (Guyton P. O.).
W. A. Johnson, Pineara, Ga.	D. M. Weitman, Bethel, Ga. (Guyton P. O.).
R. L. Elkins, Pineara, Ga.	J. R. Hurst, Ardmore, Ga. (Egypt P. O.).
W. R. Fetzer, Marlow, Ga.	G. M. Thompson, Ardmore, Ga.
B. N. Shearouse, Marlow, Ga.	A. J. Bevil, Kildare, Ga.
Dr. L. H. Lanier, Marlow, Ga.	Wm. Cannet, Tusculum, Ga.
J. W. Reisser, Stillwell, Ga. (Clyo P. O.).	D. H. Clark, Tusculum, Ga.
C. B. Guann, Stillwell, Ga. (Clyo P. O.).	David Lawrence, Tusculum, Ga.
W. C. Reisser, Stillwell, Ga. (Clyo P. O.).	Wm. Speir, Tusculum, Ga.
H. B. Kieffer, Stillwell, Ga. (Clyo P. O.).	
J. C. Zipperer, Coldbrook, Ga. (Rincon P. O.).	

IMPROVEMENT OF MILL CREEK.

In order to arrive at a fair estimate of the cost of improving the drainage conditions of the lands of Effingham County, it was decided to take one of the representative creeks and work up, roughly, a plan of drainage for its watershed, which would in general hold good for most of the creeks of the county. Accordingly, Mill Creek was chosen for this purpose, both because it is a typical stream and on account of its accessibility, it being near Guyton and Pineara, Ga.; also more interest in drainage seems to be taken by the people living in this watershed than elsewhere in the county.

The watershed of Mill Creek (containing 12,220 acres) is for the most part flat and sandy, but is somewhat rolling in localities. The headwaters of this creek are in a large flat bay, which would be drained by the proposed improvement.

To obtain the detailed information essential for planning the system it was necessary to run a line of levels down the edge of the swamp, taking frequent side readings in the swamp. At the same time a stadia-compass traverse was made, so that the line of levels and edge of swamp could be platted. One rodman and two axmen were used and the work consumed four days, during which time the writer was

U.S. DEPARTMENT OF AGRICULTURE — OFFICE OF EXPERIMENT STATIONS

DRAINAGE INVESTIGATIONS

SKETCH MAP OF

PORTION OF MILL CREEK

EFFINGHAM COUNTY

GEORGIA

To accompany a Report upon the Drainage of the County

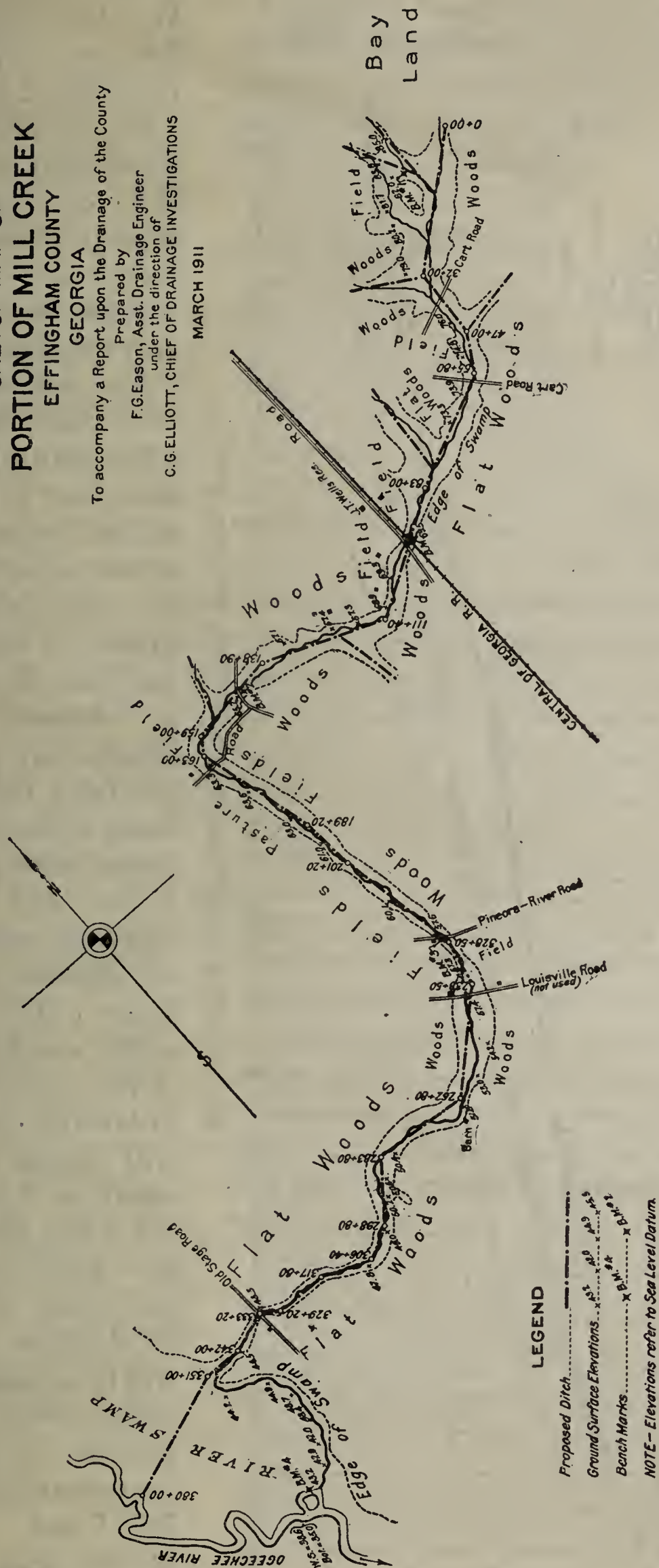
Prepared by

F.G.Eason, Asst. Drainage Engineer

under the direction of

C.G.ELLIOTT, CHIEF OF DRAINAGE INVESTIGATIONS

MARCH 1911



SCALE IN FEET
1000 0 1000 2000 3000 4000 5000

G.F.P.del

Fig. 2.—Sketch map of a portion of Mill Creek, Effingham County, Ga., showing proposed drainage district.

FIG. 3.—Profile of proposed drainage ditch, Mill Creek, Effingham County, Ga.

It is proposed to provide good drainage to all the land in this watershed, and to do this it will be necessary to construct a canal through the entire length of Mill Creek. A 6-foot depth has been decided upon as necessary for this canal so as to give a good fall from the adjoining lands to the canal and a corresponding lowering of the water table. To carry the assumed run-off one-half inch in 24 hours a ditch of 6-foot depth, one-half to 1 side slopes, and with the fall obtainable (see fig. 3) will require a bottom width of 8 feet at the lower end, decreasing in size down to 3 feet as the creek is ascended. In addition to this it will be necessary to construct about 12 miles of laterals in the small branches which flow into Mill Creek. A system of this kind, reaching

out to all points of the watershed, will give ready outlet to all the adjacent land, so that by digging small field ditches that discharge into the main canal or into the laterals a complete system of drainage will be effected. It will be noticed that the map and profile do not extend above a point opposite Old Christian Church, but the improvement should be carried on up into the bay and several branches run into it, so as to collect the water quickly. These should be ditches 4 or 5 feet deep, having 2 to 3 foot bottoms.

METHOD OF CONSTRUCTION.

If the proposed Mill Creek canal were constructed just large enough to carry the assumed run-off, it would probably be necessary to do the excavation by hand, as the ditch would be too small to accommodate a floating dredge and the wet nature of the ground would preclude the use of a dry-land machine. It is proposed, therefore, to enlarge the section of the ditch below the Central of Georgia Railroad, so that a dipper dredge can be used in this portion. This will require a ditch having a bottom width of 14 feet, a top width of 20 feet, and a depth of 6 feet. A dipper dredge can then be set up at the Central of Georgia Railroad bridge and work downstream and complete this portion considerably cheaper than can be done by handwork, notwithstanding the fact that the ditch must be made larger than necessary in order to use the dredge. The portion of the Mill Creek canal above the railroad bridge and all of the laterals will probably have to be dug by hand, owing to their small size.

The dredge work in the estimate which follows is estimated at 12 cents per yard. This is high for dredge work under favorable conditions, but owing to the small yardage in this job as compared with the cost of getting the machine on the ground a higher price must be expected than if the work involved several hundred thousand yards. The contractor could, however, reasonably expect work on the other districts which would certainly be formed after the organization of the first district. For this reason it is highly advantageous, when drainage work is contemplated in any district, to arrange so that all the work that can be handled with one setting up of machine shall be done at the same time under one contract. This would not hold, however, where the project was so large that the yardage ceased to affect the unit price and where it might be advisable to divide up the work in order to shorten the time of construction.

The laterals and that part of the Mill Creek canal above the railroad will, it is assumed, be done by hand, and this work has been estimated at 20 cents per cubic yard.

ESTIMATE OF COST.

The amount of excavation noted in the following estimate of cost is calculated from the profile of the ditch as shown in fig. 3.

In the estimate no allowance is made for cost of right of way, as the ditches would be dug almost entirely in existing waterways. The cost per yard for dredge work is intended to include the cost of clearing a right of way for the main canal.

Estimate of cost.

Mill Creek Ditch:

109,000 cubic yards dredge excavation, at 12 cents per yard	\$13,080
13,000 cubic yards hand excavation, at 20 cents per yard	2,600

Laterals:

64,700 cubic yards hand excavation, at 20 cents per yard	12,940
Contingent expense, at 10 per cent	2,862

Total	31,482
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Number of acres benefited, 12,220.

Average cost per acre, \$2.58.

[Cir. 113]

APPENDIX.

BENCH MARKS ALONG CENTRAL OF GEORGIA RAILROAD.

[Obtained from the Central of Georgia R. R. Co.]

Location and description.	Elevation.
Mile post 15, top of stone post.....	35. 65
Mile post 16, top of stone post.....	32. 08
Mile post 18, top of stone post.....	41. 84
Mile post 19, top of stone post.....	39. 51
Mile post 21, top of stone post.....	53. 66
Mile post 22, top of stone post.....	51. 04
Mile post 23, top of stone post.....	50. 92
Mile post 24, top of stone post.....	59. 00
Mile post 25, top of stone post.....	62. 07
Mile post 26, top of stone post.....	79. 85
Mile post 28, top of stone post.....	80. 05
Mile post 29, top of stone post.....	76. 15
Mile post 31, top of stone post.....	106. 54
Mile post 32, top of stone post.....	98. 50
Mile post 33, top of stone post.....	114. 82
Mile post 34, top of stone post.....	115. 52
Mile post 36, top of stone post.....	130. 20
Mile post 38, top of stone post.....	130. 69
Mile post 39, top of stone post.....	133. 28
Mile post 41, top of stone post.....	139. 99
Mile post 43, top of stone post.....	134. 86
Mile post 44, top of stone post.....	137. 39
Meldrim station on northeast corner of northeast pedestal of foundation of water tank on G. & A. R. R., back of station.....	36. 585
Eden station, on top iron property post (old rail).....	38. 62
Guyton station, in window sill of depot	91. 21
Tusculum station; track spike in warehouse brewer (station 1853)	134. 28
Egypt station, on door sill of pumping station	136. 37
Oliver station (Screven County); on door sill of waiting room near track.	116. 61



BENCH MARKS ALONG SAVANNAH RIVER.

[Obtained from U. S. Engineer's Office, Savannah, Ga.]

Bench-mark No.	Elevation.	Location and description.
28	45.77	Description lacking. Low water at B. M.=34.67.
29	62.03	Description lacking.
29 A	52.21	Description lacking. Low water at B. M.=30.51.
30	38.34	Description lacking. Low water at B. M.=27.84.
31	50.85	About 125 feet from river and 15 feet back from east corner freight house at Bosticks Landing; on 4 nails (. : .) driven into cut point on south side of root of water oak 40 inches in diameter. Low water at B. M.=24.25.
32	36.03	100 feet from river bank and 8 feet north of small creek at Sisters Ferry, Ga., on 4 nails (. : .) driven into cut point 1.5 feet above the ground on north side of 12-inch white oak. Low water at B. M.=20.03.
33	30.52	About 25 feet from right bank of river and about 160 feet below mouth of a gut 40 feet wide as shown at 43.9 miles; on 4 nails (. : .) driven into cut point 1 foot above ground on north side of 24-inch black gum. Tree is blazed on side toward river and stands among pine trees. Low water at B. M.=19.12.
34	23.67	About 70 feet from river at Gaffneys Landing and about 140 feet below a creek 15 feet wide; on 4 nails (. : .) driven into cut point on north root of 15-inch hickory. Low water at B. M.=15.82.
35	35.05	About 100 feet from river and in angle between roads leading to lower landing at Ebenezer Church; on 4 nails (. : .) driven into cut point on north root of 38-inch sweet gum. Low water at B. M.=14.05.
36	21.48	At southeast corner of upper wharf at Puyrsburg, S. C., in edge of bank 10 feet from water; on 4 nails (. : .) driven into cut point 1.5 feet above ground on west side of 16-inch short-leaf pine. Low water at B. M.=6.60.
36 A	23.11	About 100 feet from river and about 100 feet above upper wharf at Puyrsburg, S. C.; on a cross (X) cut into top of brick in upper projecting course of brick at northwest corner of chimney at north end of a new house about 18 feet square. Next brick above B. M. marked with "U. S." cut into face.
37	16.99	Top of southwest pier of A. C. L. R. R. bridge across Savannah River, 14 miles on the lower side of bridge; on cross (X) cut into top of granite coping. Low water at B. M.=3.70.

BENCH MARKS SET BY DRAINAGE INVESTIGATIONS.

1	83.70	Mill Creek swamp about opposite Old Christian Church; nail in 15-inch red oak at southeast corner of field.
2	65.74	Mill Creek swamp at road 1 mile west of Central of Georgia R. R.; nail in 15-inch black gum on east side road near run.
3	60.90	Mill Creek swamp; Pinsora River road; nail in telephone pole 50 feet west of run.
4	42.51	East bank slough near Ogeechee River about 300 feet north of Mill Creek; nail in base of 12-inch white oak.